# QUICK FILL CAP FOR A TOY WATER GUN

## Reference to Related Application

**[0001]** This application is a continuation-in-part of U.S. Patent Application Serial No. 10/361,916, filed February 10, 2003 by Fred D. Eddins and Robert L. Brown.

## Background of the Invention

**[0002]** The present invention is directed to a toy water gun, and more particularly to a quick fill cap for a toy water gun that may facilitate filling a tank of the toy water gun with a liquid without removing the quick fill cap, and that may further prevent leakage of liquid disposed within the tank when the toy water gun is inverted or otherwise positioned with the liquid bearing against the quick fill cap.

**[0003]** Various toy water guns wherein a one-way valve is implemented to regulate the flow of the liquid disposed therein have been previously described. For example, U.S. Patent No. 6,234,347 to Amron discloses a toy water gun operable in accordance with two distinct modes of operation. In a first mode of operation, the toy water gun receives and stores pressurized water directly from a municipal water supply. This is achieved using an adaptor which allows water to flow under pressure into a reservoir of the gun such that the user needs only to press a trigger to cause water to eject through the nozzle of the gun. In a second mode of operation, a fill cap or other opening is exposed so that unpressurized water may be poured in or otherwise received into the gun. A manually operable pump is included so that the unpressurized water may be pressurized where upon depression of the trigger will cause the water to be ejected from the gun. An adapter includes a one-way valve assembly connected to an end of a tube such that pressurized water available from a municipal water supply may be introduced into the tube and thereafter into a reservoir. The one-way valve will permit the liquid to flow freely in one direction into the reservoir, and prevents the liquid from flowing in the opposition direction.

**[0004]** U.S. Patent No. 5,141,132 to Whelan discloses a water pistol which includes an elongated, flexible tube removably connectable to the grip of the pistol. The tube receives water under pressure directed through the body of the pistol from an inlet port located at the rear or butt end of the pistol. The pistol also serves to force

the discharged water through a front nozzle of the pistol when the user pulls a trigger. A fill port includes a fill check valve and O-ring that serves to prevent the back flow of water from a tube through the fill port. The positioning of the check valve is guided by the seat provided within a chamber formed in an upper body portion of the water pistol.

## Summary of the Invention

**[0005]** In one aspect, the invention is directed to a quick fill cap for a toy gun capable of discharging an output stream of liquid. The toy gun may have a liquid reservoir for storing a quantity of liquid and a fill port for depositing liquid in to the liquid reservoir. The quick fill cap may include a cap portion having a throughbore, wherein the cap portion may be adapted to demountably attach to the fill port of the toy gun and to form a substantially air-tight and water-tight seal with the fill port. The quick fill cap may further include a one-way valve connected to the cap portion proximate an opening of the throughbore. The one-way valve may be disposed on the interior of the liquid reservoir when the cap portion is demountably attached to the fill port, and the one-way valve may be adapted to allow liquid to flow from the exterior of the liquid reservoir through the channel formed by the throughbore of the cap portion and into the reservoir. The one-way valve may further be adapted to prevent liquid from flowing from the interior of the liquid reservoir through the channel formed by the throughbore of the cap portion to the exterior of the reservoir. Additionally, the quick fill cap may include a support member disposed within the one-way valve when the one-way valve is connected to the cap portion. The support member may be adapted to prevent the one-way valve from collapsing and entering the throughbore of the cap portion, and may be adapted to allow liquid to flow between the throughbore and the one-way valve.

**[0006]** In another aspect, the invention is directed to a quick fill cap for a toy gun capable of discharging an output stream of liquid. The toy gun may have a liquid reservoir for storing a quantity of liquid and a fill port for depositing liquid in to the liquid reservoir. The quick fill cap may include a cap portion having a throughbore, wherein the cap portion may be adapted to demountably attach to the fill port of the toy gun and to form a substantially air-tight and water-tight seal with the

fill port. The quick fill cap may further include an umbrella valve connected to the cap portion and having a valve body disposed proximate an opening of the throughbore. The one-way valve may be disposed on the interior of the liquid reservoir when the cap portion is demountably attached to the fill port. The umbrella valve may be adapted so that the valve body engages the cap portion to prevent liquid from flowing from the interior of the liquid reservoir through the channel formed by the throughbore of the cap portion to the exterior of the reservoir, and so that the valve body disengages to allow liquid to flow from the exterior of the liquid reservoir through the channel formed by the throughbore of the cap portion and into the reservoir.

**[0007]** In yet another aspect, the invention is directed to a toy gun capable of discharging an output stream of liquid. The toy gun may include a liquid reservoir for storing a quantity of liquid, and a fill port for depositing liquid into the liquid reservoir, the fill port having a threaded outer surface and a first groove in a portion of the threaded outer surface. The toy gun may further comprise a quick fill cap having a cap portion having a throughbore and a threaded inner surface that may be adapted to engage the threaded outer surface of the fill port and to form a substantially air-tight and water-tight seal between the cap portion and the fill port. The cap portion may have a second groove in a portion of the threaded inner surface corresponding to the first groove, wherein the first and second grooves define a channel adapted to place the liquid reservoir in fluid communication with the atmosphere external to the liquid reservoir when the first and second grooves are aligned as the cap portion is turned about the fill port.

**[0008]** Further, the cap portion of the toy gun may include a one-way valve connected to the cap portion proximate an opening of the throughbore opposite the hollow funnel. The one-way valve may be disposed on the interior of the liquid reservoir when the cap portion is demountably attached to the fill port, and the one-way valve may be adapted to allow liquid to flow from the exterior of the liquid reservoir through the channel formed by the throughbore of the cap portion and into the reservoir. The one-way valve may further be adapted to prevent liquid from

flowing from the interior of the liquid reservoir through the channel formed by the throughbore of the cap portion to the exterior of the reservoir.

**[0009]** In a further aspect, the invention is directed to a quick fill cap for a toy gun capable of discharging an output stream of liquid, the toy gun having a liquid reservoir for storing a quantity of liquid and a fill port for depositing liquid in to the liquid reservoir. The quick fill cap may include a cap portion having a throughbore, with the cap portion demountably engaging the fill port of the toy gun when the cap portion is disposed thereon, and forming a substantially air-tight and water-tight seal with the fill port. The quick fill cap may also include a valve body slidably connected to the cap portion proximate an opening of the throughbore and at least partially disposed within the channel formed by the throughbore. The valve body may be disposed on the interior of the liquid reservoir when the cap portion is demountably attached to the fill port, with the valve body being slidable between a closed position wherein the valve body engages the cap portion to prevent liquid from flowing from the interior of the liquid reservoir through the channel formed by the throughbore of the cap portion to the exterior of the reservoir, and an open position wherein the valve body disengages from the cap portion to allow liquid to flow from the exterior of the liquid reservoir through the channel formed by the throughbore of the cap portion and into the reservoir. The quick fill cap may further include a biasing member engaging the valve body and the cap portion, and biasing the valve body toward the closed position.

**[0010]** In a still further aspect, the invention is directed to a quick fill cap for a toy gun capable of discharging an output stream of liquid, the toy gun having a liquid reservoir for storing a quantity of liquid and a fill port for depositing liquid in to the liquid reservoir. The quick fill cap may include a cap portion having a throughbore, with the cap portion demountably attaching to the fill port of the toy gun when the cap portion is disposed thereon, and forming a substantially air-tight and water-tight seal with the fill port. The quick fill cap may further include a one-way valve connected to the cap portion proximate an opening of the throughbore, wherein the one-way valve is disposed on the interior of the liquid reservoir when the cap portion is demountably attached to the fill port, may allow liquid to flow from the

exterior of the liquid reservoir through the channel formed by the hollow funnel and the throughbore of the cap portion and into the reservoir, and may prevent liquid from flowing from the interior of the liquid reservoir through the channel formed by the throughbore of the cap portion to the exterior of the reservoir.

**[0011]** Addition aspects of the invention are defined by the claims of this patent.

## Brief Description of the Drawings

**[0012]** FIG. 1 is a side view of a toy water gun having an embodiment of a quick fill cap attached to a fill port.

**[0013]** FIG. 2 is a side perspective view of the quick fill cap of FIG. 1.

**[0014]** FIG. 3 is a side exploded view of the quick fill cap of FIG. 1.

**[0015]** FIG. 4 is a partial side sectional view of the toy water gun and quick fill cap of FIG. 1 being engaged by a hose or faucet outlet.

**[0016]** FIG. 5 is a partial side sectional view of the toy water gun and quick fill cap of FIG. 1 in an inverted position.

**[0017]** FIG. 6 is a side perspective view of another embodiment of a quick fill cap.

**[0018]** FIG. 7 is a side exploded view of the quick fill cap of FIG. 6.

**[0019]** FIG. 8 is a partial side sectional view of a toy water gun and the quick fill cap of FIG. 6 being engaged by a hose or faucet outlet.

**[0020]** FIG. 9 is a partial side sectional view of a toy water gun and the quick fill cap of FIG. 6 in an inverted position.

**[0021]** FIG. 10 is a side exploded view of an alternative embodiment of a quick fill cap.

**[0022]** FIG. 11 is a partial side sectional view of the toy water gun and quick fill cap of FIG. 10 being engaged by a hose or faucet outlet.

**[0023]** FIG. 12 is a partial side sectional view of the toy water gun and quick fill cap of FIG. 10 with the toy water gun pressurized.

**[0024]** FIG. 13 is a partial side sectional view of another embodiment of the cap portion of a quick fill cap.

**[0025]** FIG. 14 is a side view of an embodiment of a fill port for a toy water gun.

**[0026]** FIG. 15 is a partial side sectional view of the quick fill cap and the toy water gun of FIGs. 13 and 14, respectively, with the water gun pressurized.

**[0027]** FIG. 15A is a cross-sectional view taken along line 15--15 of FIG. 15.

**[0028]** FIG. 16 is a partial side sectional view of the quick fill cap and toy water gun of FIGs. 13 and 14, respectively, with the quick fill cap partially unscrewed.

**[0029]** FIG. 16A is a cross-sectional view taken along line 16--16 of FIG. 16.

**[0030]** FIG. 17 is a side exploded view of a further alternative embodiment of a quick fill cap.

**[0031]** FIG. 18 is a partial side sectional view of the toy water gun and quick fill cap of FIG. 17.

**[0032]** FIG. 19 is a partial side sectional view of a toy water gun and the quick fill cap of FIG. 17 being engaged by a hose or faucet outlet.

**[0033]** FIG. 20 is a side sectional view of an additional embodiment of a quick fill cap in a closed position.

**[0034]** FIG. 21 is a side sectional view of the quick fill cap of FIG. 20 in an open position.

**[0035]** FIG. 22 is a side sectional view of a still further embodiment of a quick fill cap in a closed position.

**[0036]** FIG. 23 is a side sectional view of the quick fill cap of FIG. 22 in an open position.

**[0037]** FIG. 24 is a side sectional view of yet another embodiment of a quick fill cap in a closed position.

**[0038]** FIG. 25 is a side sectional view of the quick fill cap of FIG. 24 in an open position.

Detailed Description of Various Embodiments

**[0039]** Although the following text sets forth a detailed description of numerous different embodiments of the invention, it should be understood that the legal scope of the invention is defined by the words of the claims set forth at the end of this patent. The detailed description is to be construed as exemplary only and does not describe every possible embodiment of the invention since describing every possible embodiment would be impractical, if not impossible. Numerous alternative embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims defining the invention.

**[0040]** It should also be understood that, unless a term is expressly defined in this patent using the sentence "As used herein, the term '_____' is hereby defined to mean..." or a similar sentence, there is no intent to limit the meaning of that term, either expressly or by implication, beyond its plain or ordinary meaning, and such term should not be interpreted to be limited in scope based on any statement made in any section of this patent (other than the language of the claims). To the extent that any term recited in the claims at the end of this patent is referred to in this patent in a manner consistent with a single meaning, that is done for sake of clarity only so as to not confuse the reader, and it is not intended that such claim term by limited, by implication or otherwise, to that single meaning. Finally, unless a claim element is defined by reciting the word "means" and a function without the recital of any structure, it is not intended that the scope of any claim element be interpreted based on the application of 35 U.S.C. § 112, sixth paragraph.

**[0041]** FIG. 1 illustrates a toy water gun 10 having a quick fill cap 12 removably attached to a fill port 14 of a tank or reservoir 16. The toy water gun 10 may be a pressurized toy water squirt gun that uses a self-contained pressurizing mechanism to pressurize a reservoir, such as the tank 16, to create a pressure differential between the reservoir and the ambient atmosphere such that the liquid contained therein may be propelled from the toy as an output stream of liquid discharged from a nozzle, such as nozzle 18. One example of a pressurizing mechanism that may be disposed within the toy water gun 10 is disclosed in U.S. Patent No. 5,305,919, entitled "Pinch Trigger Hand Pump Water Gun with Non-Detachable Tank," which issued on April 26, 1994, and which is expressly incorporated herein by reference in its entirety. Of course, other pressurizing mechanisms are well-known in the art and may be implemented in the toy water gun 10 having the quick fill cap 12. Alternatively, the toy water gun 10 may be a toy squirt gun of the type having a trigger 20 integrated with a pump disposed within the toy water gun 10 such that pulling the trigger 20 may operate the pump to supply pressure causing an output stream of liquid at the nozzle 18. One example of a toy squirt gun having an integrated trigger and pump is disclosed in U.S. Patent No. 4,334,383, entitled "Water Sprinkling Toy Pistol with Bubble-Blowing Ring," which issued on June 15, 1982, and which is expressly incorporated herein by reference in its entirety. Of course, other mechanical and electro mechanical mechanisms for causing an output stream of liquid from a nozzle of a toy water gun are well known in the art and are contemplated as having use in the toy water gun 10 utilizing the quick fill cap 12.

**[0042]** As previously discussed the toy water gun 10 includes a tank 16 that may have a quantity of liquid disposed therein that may be discharged in an output stream from the nozzle 18 when the trigger 20 is activated by the user. The toy water gun 10 may include a housing 22 supporting the tank 16 and enclosing the discharge mechanism of the toy water gun 10, and having a handle 24 dispose proximate the trigger 20 which may be grasped by the user when using the toy water gun 10. If a pressurizing mechanism as previously described is implemented in the toy water gun 10, the toy water gun 10 may further include a pump handle 26 extending from the

housing 22 that may allow the user to pump a piston or other mechanism to pressurize the liquid disposed within the tank 16.

**[0043]** The quick fill cap 12 detachably connected to the fill port 14 may include an external funnel 28 and cap portion 30 that may be engaged by the user to attach and detach the quick fill cap 12 at the fill port 14. The funnel 28 may be tapered, shaped as a truncated cone or otherwise configured to receive an outlet capable of discharging a stream of liquid. The cap portion 30 may also include a throughbore aligning with an open end of the funnel 28 to form a continuous channel when the funnel 28 is attached to the cap portion 30. Referring to FIG. 2, an embodiment of the quick fill cap 12 may further include a one-way valve 32 that may be connected to the cap portion 30 such that the one-way valve 32 may be disposed within the tank 16 when the quick fill cap 12 is attached to the fill port 14. In the illustrated embodiment, the one-way valve 32 may be a duck bill valve that may be implemented as a sleeve formed from an elastomeric material, such as rubber, and having diametrically opposed creases 33 such that the sleeve may be substantially flat when not attached to the cap portion 30 with diametrically opposed portions of the sleeve being in contact or being disposed in close proximity.

**[0044]** As illustrated in FIG. 3, the cap portion 30 may further include a downwardly extending hollow stem 34, which may be tapered, and on to which an open end 36 of the sleeve may be disposed. The open end 36 of the sleeve and the stem 34 may be dimensioned such that the open end 36 engages the outer surface of the stem 34 to create a substantially air-tight and water-tight seal and form a continuous channel through the hollow cap portion 30 and one-way valve 32. Alternatively, the open end 36 may be secured to the exterior surface of the stem 34 by an adhesive disposed between the open end 36 and the stem 34, a taught band around the exterior of the open end 36 at the stem 34, or by any other mechanism for securing the open end 36 to the stem 34 to form a substantially air-tight and water-tight seal. When the sleeve is disposed on the stem 34, the end 38 of the sleeve opposite the open end 36 may be substantially closed due to the generally flat configuration of the sleeve caused by the diametrically opposed creases 33. In this configuration, the closed end 38 may allow fluid poured through the openings of the

funnel 28 and cap portion 30 to flow out of the closed end 38 while also being capable of forming a substantially water-tight seal at the closed end 38 to prevent liquid from flowing into the quick fill cap 12 in the opposite direction. While the one-way valve 32 is illustrated and described herein as being a duck bill-type valve, it would be understood by those skilled in the art that the one-way valve 32 may be any conventional one-way or check valve, such as a ball or flat valve or the like, which will permit the liquid to flow freely in one direction, such as through the funnel 28, cap portion 30 and one-way valve 32, and out the closed end 38, and which prevents the liquid from flowing in the opposite direction.

**[0045]** Referring now to FIG. 4, the quick fill cap 12 may be connected to the fill port 14 so that an outlet 40 of a hose, faucet, watering can, or the like, may discharge an output stream of liquid 42 through the quick fill cap 12 and into the tank 16 to form an accumulated amount of liquid 44. In the illustrated embodiment, the cap portion 30 may have a threaded inner surface 46 configured to engage and mate with a corresponding threaded outer surface 48 of the fill port 14 such that a substantially air-tight and water-tight seal is formed when the cap portion 30 is screwed onto the fill port 14 with a sufficient amount of torque. Of course, other mechanisms for connecting the quick fill cap 12 to the fill port 14 to form a substantially air-tight and water-tight seal are well known and are contemplated as having use with the quick fill cap. The funnel 28 may be configured to receive outlets 40 having varying outer diameters such that the outer surface of the outlet 40 may, if desired, engage the inner surface of the funnel 28. The funnel 28 may be fabricated from a resilient or semi-resilient material, such as rubber, so that a substantially water-tight seal may be formed between the engaged outer surface of the outlet 40 and inner surface of the funnel 28. The funnel 28 may be connected to the cap portion 30 by an adhesive or other connection mechanism by which a substantially water-tight seal is formed between the engage surfaces of the funnel 28 and cap portion 30. Alternatively, the funnel 28 and cap portion 30 may be fabricated as a single unitary component from a single piece of material. Moreover, the one-way valve 32 may also be integrally formed with the stem 34 as a single unitary component.

**[0046]** As shown in the figure, when the outlet 40 is disposed within the funnel 28, an output stream of liquid 42 may be discharged from the outlet 40 through the continuous channel form by the funnel 28, the cap portion 30 and the one-way valve 32. The force of the output stream of liquid 42 on the inner surface of the one-way valve 32 may be sufficient to cause the open end 38 of the one-way valve 32 to open, thereby allowing the output stream of liquid 42 to flow into the tank 16 and increase the accumulated amount of liquid 44. When the outlet 40 is removed from the funnel 28 or the output stream of liquid 42 is otherwise discontinued, thereby eliminating the force of the output stream of liquid 42 against the inner surface of the one-way valve 32, the restorative force of the resilient material from which the one-way valve 32 is fabricated causes the one-way valve 32 proximate the closed end 38 to flatten and thereby cause the diametrically opposed portions of the inner surface of the one-way valve 32 to again be engaged or disposed in close proximity to prevent the accumulated liquid 44 from flowing into the quick fill cap 12 through the closed end 38 as discussed hereinafter.

**[0047]** Once the output stream of liquid 42 is discontinued, the one-way valve 32 of the quick fill cap 12 may prevent the accumulated liquid 44 from flowing out through the fill port 14 as long as the quick fill cap 12 is disposed thereon. For example, FIG. 5 illustrates the portion of the tank 16 proximate the fill port 14 when the toy water gun 10 is inverted. As the toy water gun 10 is inverted and the liquid 44 accumulates at the fill port 14, the seal between the cap portion 30 and the fill port 14 prevents the liquid 44 from leaking out between the threaded inner surface 46 and threaded outer surface 48. At the closed end 38 of the one-way valve 32, the force exerted by the accumulated liquid 44 on the outer surface of the valve 32 increases the sealing force at the closed end 38 to prevent leakage of the accumulated liquid 44 through the closed end 38. Similarly, the force of the accumulated liquid 44 bearing on the outer surface of the sleeve proximate the open end 36 increases the sealing force between the open end 36 and the stem 34. As a result, the accumulated liquid 44 is retained in the tank 16 as the quick fill cap 12 prevents the accumulated liquid 44 from flowing out of the tank 16 through the fill port 14.

**[0048]** In some implementations, it may be desirable to prevent the excessive buildup of pressure within the tank 16 as liquid is discharged into the tank 16 by the outlet 40. In such implementations, it may be desirable to adapt a quick fill cap to allow air to escape from the tank 16 as the tank 16 is being filled with liquid, while still preventing the accumulated liquid 14 from flowing out of the tank 16 through the fill port 14 while the quick fill cap is attached thereto. FIGS. 6 and 7 illustrate one embodiment of a quick fill cap 50 that may facilitate the release of air from the tank 16 as the tank 16 is being filled by liquid discharged from the outlet 40. The quick fill cap 50 may include a funnel 52 having a vent 54 integrally formed therein to facilitate release of air from the tank 16. The quick fill cap 50 may further include a cap portion 56 having a ball 58 disposed within a cavity 60 formed in the cap portion 56 and stem 62, thereby forming a ball valve that may allow air to be discharged from the tank 16 while sealing the tank 16 to prevent the accumulated liquid 44 from flowing out of the fill port 14 while the quick fill cap 50 is attached thereto.

**[0049]** Referring to FIG. 8, the quick fill cap 50 is illustrated with the outlet 40 discharging an output stream of liquid 42 through the quick fill cap 50 to increase the amount of accumulated liquid 44. As discussed with the previous embodiment, the cap portion 56 may include a threaded inner surface mating with a threaded outer surface 66 of the fill port 14. The cavity 16 may be integrally or otherwise formed within the cap portion 56 and stem 62 and extend from a first opening 68 in the outer wall of the stem 62 to a second opening 70 in an upper surface of the cap portion 56 that may be aligned with the vent 54 of the funnel 52 when the funnel 52 is attached to the cap portion 56 to form a substantially water-tight seal with the ball 58 disposed within the cavity 60.

**[0050]** Configured in this way, two channels are formed in the quick fill cap 50 placing the outside atmosphere in fluid communication with the interior of the tank 16 when the quick fill cap 50 is attached to the fill port 14. The first channel is formed by the funnel 52, the cap 56 and stem 62, and the one-way valve 32 to permit the output stream of liquid 42 discharged from the outlet 40 to flow into the tank 16 while preventing the accumulated liquid 44 from flowing back through the closed end

of the one-way valve 32 as previously described. The second channel may be formed by the vent 54 and ball valve cavity 60 that, in the absence of the ball 58, would allow bi-directional flow of air and liquid between the outer atmosphere and the interior of the tank 16. However, the ball 58 may be disposed within the cavity 60 to prevent the accumulated liquid 44 from flowing out of the tank 16 through the cavity 60 and vent 54. The cavity 60 may have an inner diameter that may be larger than the outer diameter of the ball 58 to allow the ball 58 to move between the first opening 68 and the second opening 70. The first opening 68 may be dimensioned such that the ball 58 engages the first opening 68 to prevent the ball 58 from passing through the outer surface of the stem 62. The first opening 68 may be circular such that the ball 58 is seated in the first opening 68 when the ball 58 is disposed thereby or, alternatively, the first opening 68 may be configured such that the ball 58 is not fully seated in the first opening 68 so that air and liquid may be free to pass around the ball 58 when the ball 58 is disposed at the first opening 68. In order to allow the ball 58 to be disposed within the cavity 60, the second opening 70 may be dimensioned such that the ball 58 may freely pass through the second opening 70 when the funnel 52 is not connected to the cap portion 56. In order to retain the ball 58 within the cavity 60 while providing the previously discussed second channel, the vent 54 may be dimensioned such that the ball 58 may not pass through the opening 70 and into the vent 54 when the funnel 52 is attached to the cap portion 56. Further, the vent 54 may be dimensioned such that the ball 58 is engaged by and seated in the vent 54 when the ball 58 is disposed at the second opening 70, thereby allowing the ball 58 and vent 54 to form a substantially air-tight and water-tight seal.

**[0051]** As the output stream of liquid 42 is discharged into the tank 16 through the quick fill cap 12 by the outlet 40 as shown in FIG. 8, the outlet 40 may be engaged by the inner surface of the funnel 52 to form a substantially air-tight and water-tight seal. If air is not released from the tank 16, the pressure inside the tank 16 will increase as the accumulated liquid 44 increases and reduces the volume occupiable by the air in the tank 16. As the pressure increases in the tank 16 having the quick fill cap 50 attached to the fill port 14, the air in the tank 16 may enter the cavity 60 through the first opening 68, around the ball 58, out of the cavity through

the second opening 70 and through the vent 54 to the outer atmosphere. If the ball 58 is seated in the lower opening 68, a minimum amount of pressure in the tank 16 may be necessary for the air to move the ball 58 out of engagement with the first opening 68. Conversely, if the ball 58 does not seat within the first opening 68, the air may be free to pass into the first opening 68 and around the ball 58 without attaining a minimum pressure necessary to move the ball 58.

**[0052]** Once the tank 16 is filled and the outlet 40 is removed from the funnel 52, the ball 58 may prevent the accumulated liquid 44 from leaking onto the tank 16 through the channel formed by the cavity 60 and vent 54 as illustrated in FIG. 9. When the toy water gun 10 and, consequently, the tank 16 are inverted, the ball 58 may move within the cavity 60 from the first opening 68 to the second opening 70 where the ball 58 is engaged by the vent 54. In order to facilitate a water-tight seal between the ball 58 and the vent 54, the funnel 52 may be fabricated from rubber or other resilient or semi-resilient material that will conform to the surface of the ball 58 under the weight of the ball 58 and the liquid 44 accumulated behind the ball 58 in the cavity 60. When the toy water gun 10 is restored to the upright position of FIG. 8, the ball 58 unseats from the vent 54 at the second opening 70 and moves within the cavity 60 downwardly to the first opening 68. While the quick fill cap 50 is illustrated and described herein as having a ball valve for releasing air from the tank 16 while retaining the accumulated water 44 therein, the quick fill cap 50 may incorporate any conventional one-way or check valve, such as a flap valve or the like, which will permit air in the tank 16 to flow freely in one direction out of the quick fill cap 50, in which prevents the accumulated liquid 44 from flowing out of the tank 16 through the same channel.

**[0053]** As previously discussed, the quick fill cap 12 may be implemented in toy water guns that may include self-contained pressurizing mechanisms to pressurize the liquid in the tank 16 and facilitate propulsion of the output stream of liquid discharge from the nozzle 18. Some pressurizing mechanisms may be able to generate sufficient pressure to cause the elastomeric sleeve of the one-way valve 32 to collapse and invert within the cavity of the stem 34, thereby allowing the pressurized air and liquid 44 to leak out through the quick fill cap 12. An alternative embodiment

of the quick fill cap 12 configured to prevent the collapse of the one-way valve 32 is illustrated in FIGs. 10-12, in which the same reference numerals are used to refer to similar elements of the quick fill cap 12. Referring to FIG. 10, in addition to the funnel 28, cap portion 30, and one-way valve 32, the quick fill cap 12 may include an additional support member 80 disposed within the one-way valve 32 and engaged by a portion of the stem 34. During assembly of the quick fill cap 12, the support member 80 may be inserted into the open end 36 of the one-way valve 32 prior to inserting the stem 34 of the cap portion 30 into the open end 36 of the sleeve. After the one-way valve 32 and cap portion 30 are assembled, the stem 34 may engage the support member 80 to hold the support member 80 in place against the pressure exerted on the one-way valve 32 by the compressed air and liquid 44 in the tank 16, and to prevent the collapse and inversion of the one-way valve 32. Alternatively, the support member 80 may be integrally formed with the stem 34 as part of the cap portion 30, and may be inserted into the open end 36 of the sleeve along with the stem 34 when the quick fill cap 12 is assembled.

**[0054]** As discussed, the support member 80 may prevent the collapse of the one-way valve 32 under pressure from the compressed air and water 44 in the tank 16. While providing support for the one-way valve 32, the support member 80 may also include openings 82 to allow liquid to flow through the quick fill cap 12. As shown in FIG. 11 with the quick fill cap 12 connected to the fill port 14, the output stream of liquid 42 discharged from the outlet 40 may flow through the continuous channel formed by the funnel 28, the cap portion 30 and the one-way valve 32 by passing through openings 82 in the support member 80. As shown in the figures herein, the support member 80 may be in the form of a cage or basket as shown in the drawings, may be configured similar to a colander or strainer with holes, or may have any other configuration wherein the support member 80 provides sufficient support to prevent the collapse of the one-way valve 32 under pressure from the compressed air and water 44 in the tank 16, while allowing an output stream of liquid to flow through the quick fill cap 12 and into the tank 16, and allowing the one-way valve 32 to close and seal to retain the compressed air and liquid 44 in the tank 16.

**[0055]** Referring now to FIG. 12, the quick fill cap 12 with support member 80 is illustrated with the tank 16 being pressurized by the pressurizing mechanism of the toy water gun 10. As the pressure in the tank 16 increases, the force exerted on the outer walls of the one-way valve 32 may cause the elastomeric sleeve to collapse around and conform to the support member 80. However, as the pressure in the tank 16 increases, the support member 80 prevents the one-way valve 32 from collapsing and inverting upwardly into the cavity of the stem 34. At the same time, the increasing pressure in the tank 16 and resultant force on the outer walls of the one-way valve 32 may tighten the seal at the closed end 38 of the one-way valve 32 to prevent the compressed air and liquid 44 from leaking through the closed end 38 of the one-way valve 32.

**[0056]** When using the pressurized toy water guns 10, it may be desirable or necessary to remove the cap while the tank 16 is pressurized. When doing so, it may also be necessary or desirable to release the pressure in the tank 16 before the threads of the cap are disengaged from the threads of the fill port 14 to prevent the compressed air from projecting the quick fill cap 12. FIGs. 13-16 illustrate an embodiment of the quick fill cap 12 in which the pressure within the tank 16 may be relieved before the quick fill cap 12 is completely disengaged from the fill port 14. Pressurized air in the tank 16 may be released by providing grooves through the threads of the cap portion 30 and the fill port 14 that align to form a channel for releasing the compressed air as the quick fill cap 12 is unscrewed from the fill port 14. FIG. 13 is a partial cross sectional view of the cap portion 30 of the quick fill cap 12 showing a portion of the threaded inner surface 46 that may have a first groove 90 cut through the threads of the threaded inner surface 46. As shown in FIG. 14, the threaded outer surface 48 of the fill port 14 may have a corresponding second groove 92 cut through the threads of the threaded outer surface 48. As the quick fill cap 12 is unscrewed from the fill port 14, the first groove 90 may rotate into alignment with the second groove 92 to form a channel through which compressed air within the tank 16 may flow and be released to the atmosphere, thereby reducing the air pressure within the tank 16.

**[0057]** FIG. 15 illustrates the quick fill cap 12 screwed tightly on to the fill port 14. The inner surface of the cap portion 30 may engage the top edge of the fill port 14 to form a substantially air-tight and water-tight seal preventing the compressed air and accumulative water 44 within the tank 16 from leaking out of the fill port 14. At the same time, a substantially air-tight and water-tight seal is formed at the closed end 38 of the one-way valve 32 to prevent the compressed air and accumulated liquid from passing through the continuous channel of the quick fill cap 12. In this position, the first groove 90 and the second groove 92 (not shown) are out of alignment such that a substantially air-tight and water-tight seal is formed between the threaded inner surface 46 of the cap portion 30 and the threaded outer surface 48 of the fill port 14. As shown in the cross sectional view of FIG. 15A, the first groove 90 may be approximately one quarter turn of the quick fill cap 12 out of alignment with the second groove 92 when the quick fill cap 12 is screwed on to the fill port 14.

**[0058]** Referring to FIG. 16, the quick fill cap 12 is partly unscrewed from the fill port 14 to a position wherein the first groove 90 in the inner surface 46 of the cap portion 30 is aligned with the second groove 92 of the outer surface 48 of the fill port 14. With the quick fill cap 12 partially unscrewed, the cap portion 30 disengages from the top edge of the fill port 14, thereby placing the outside atmosphere in fluid communication with the interior of the tank 16 by allowing the compressed air to flow out of the opening of the fill port 14 and through the channel formed by the first groove 90 and second groove 92 to the surrounding atmosphere. As shown in FIG. 16A, in this embodiment, the first groove 90 may rotate into alignment with the second groove 92 to form the channel when the quick fill cap 12 is unscrewed by approximately a quarter turn. Once the grooves 90 and 92 are in alignment, the air pressure inside the tank 16 equalizes with the atmospheric pressure, and the quick fill cap 12 may be safely unscrewed and removed from the fill port 14.

**[0059]** FIGs. 17-19 illustrate an alternative embodiment of a quick fill cap 100 in which the one-way valve may be an umbrella valve. The quick fill cap 100 that may be detachably connected to the fill port 14 may include an external funnel 102 and cap portion 104 that may be engaged by the user to attach and detach the quick fill cap 100 at the fill port 14. The funnel 102 may be tapered, shaped as a

truncated cone or otherwise configured to receive an outlet capable of discharging a stream of liquid. The cap portion 104 may also include a throughbore aligned with an open end of the funnel 102 to form a continuous channel when the funnel 102 is attached to the cap portion 104. The quick fill cap 100 may further include an umbrella valve 106 that may be connected to the cap portion 104 such that the umbrella valve 106 may be disposed within the tank 16 when the quick fill cap 100 is attached to the fill port 14. The umbrella valve 106 may be formed from an elastomeric material and may include a disk shaped or semicircular valve body 108, a shaft 110 extending outwardly from approximately the center of the valve body 108, and a knob 112 disposed on the end of the shaft 110 opposite the valve body 108.

**[0060]** The cap portion 104 may further include a downwardly extending hollow stem 114, which may be tapered, with the cap portion 104 being adapted to engage and retain the umbrella valve 106. The cap portion 104 may further include a ring 116 suspended within the cap portion 104 by a plurality of ribs 118 extending inwardly from the inner surface of the cap portion 104. By suspending the ring 116 with the ribs 118 in this manner, openings 120 may allow a stream of liquid to flow through the cap portion 104 to fill the tank 16. Referring to FIG. 18, the umbrella valve 106 is connected to the cap portion 104 by inserting the knob 112 upwardly through the stem 114 and through the ring 116. The knob 112 may be dimensioned with an outer diameter larger than the inner diameter of the ring 116. When the knob 112 is forced upwardly through the ring 116, the knob 112 may initially compress as the knob 112 passes through the ring 116, and subsequently return to its normal configuration after the knob 112 passes through the ring 116. Once the knob 112 returns to its normal configuration, the knob 112 may be engaged by the ring 116 to prevent the knob 112 from passing back through the ring 116 under normal operating conditions, and thereby retaining the umbrella valve 106 in position with the quick fill cap 100. The valve body 108 and shaft 110 may be dimensioned so that the valve body 108 may engage and match with the bottom surface of the stem 114 to form a substantially air-tight and water-tight seal preventing the accumulated liquid 44 in the tank 16 from leaking out of the quick fill cap 100 through the continuous channel formed by the funnel 102 and cap portion 104, such as when the toy water gun 10 is

inverted. Moreover, as the tank 16 is pressurized by a pressurizing mechanism of the toy water gun 10, the force of the compressed air acting on the valve body 108 tightens the seal formed between the valve body 108 and the stem 114, thereby preventing the compressed air from leaking out into the atmosphere.

**[0061]** Referring now to FIG. 19, the quick fill cap 100 may be connected to the fill port 14 so that an outlet 40 of a hose, faucet, watering can, or the like, may discharge an output stream of liquid 42 through the quick fill cap 100 and into the tank 16 to form an accumulated amount of liquid 44. As shown in the FIG. 19, when the outlet 40 is disposed within the funnel 102, the output stream of liquid 42 may be discharged from the outlet 40 through the continuous channel formed by the funnel 102 and the cap portion 104. The force of the output stream of liquid 42 on the surface of the valve body 108 may be sufficient to cause the outer edges of the resilient valve body 108 to partially or fully disengage from the surface of the stem 114, thereby allowing the output stream of liquid 42 to flow into the tank 116 and increase the accumulated amount of liquid 44. Moreover, the force may cause deflection or elongation of the shaft 110 that may allow the valve body 108 to move away or otherwise disengage and unseat from the stem 114 to allow the output stream of liquid to flow into the tank 16. When the outlet 40 is removed from the funnel 102 or the output stream of liquid 42 is otherwise discontinued, thereby eliminating the force of the output stream of liquid 42 against the surface of the valve body 108, the restorative force of the resilient material from which the umbrella valve 106 is fabricated may cause the valve body 108 and or shaft 110 to return to their normal shape to again allow the valve body 108 to engage the surface of the stem 114 to prevent the accumulated liquid 44 from flowing into the quick fill cap 100 through the cavity of the stem 114. Those skilled in the art will also understand that the quick fill cap 100 having the umbrella valve 106 may also be used with toy water guns that do not use a pressurization mechanism.

**[0062]** FIGs. 20 and 21 illustrate a further alternative embodiment of a quick fill cap 130 in which the one-way valve may be the umbrella valve 106 as previously described. The quick fill cap 130 may be configured without an external funnel, and may include a cap portion 132 that may be engaged by the user to attach

and detach the quick fill cap 130 at the fill port 14. The cap portion 132 may include an inner surface 134 defining a throughbore and forming a continuous channel when a hollow stem 136 is attached at a bottom edge of the cap portion 132. In order to prevent the nozzle of a faucet or hose, or other object, from passing too far into the quick fill cap 130, a grate 138, or other structure similar to a sewer grill or grate, may extend inwardly from the inner surface 134 across the channel of the cap portion 132. The grate 138 may include openings 140 allowing liquid to pass through the channel while engaging undesired objects to prevent the object from engaging the umbrella valve 106. The cap portion 132 may also include a gasket 142, such as a washer or O-ring, disposed proximate the top of the threaded inner surface 46 of the cap portion 132 to engage the top edge of the fill port 14 when the cap portion 132 is disposed thereon to form a substantially air-tight and water-tight seal between the cap portion 132 and the fill port 14. It will be apparent to those skilled in the art that similar gaskets may also be implemented in other embodiments of quick fill caps discussed herein to similarly form substantially air-tight and water-tight seals. Those skilled in the art will further appreciate that, as with the present embodiment, the quick fill caps may be provided without external funnels, and with liquid being discharged directly into the channels of the cap portions of the quick fill caps.

**[0063]** As indicated above, the quick fill cap 130 may further include the previously-described umbrella valve 106 connected to the cap portion 132 or hollow stem 136 such that the umbrella valve 106 may be disposed within the tank 16 when the quick fill cap 130 is attached to the fill port 14. The hollow stem 136 attached to the cap portion 132 may be adapted to engage and retain the umbrella valve 106 in a similar manner as described for the hollow stem 114 of the previous embodiment. In the illustrated embodiment, a ring 144 may be suspended within the hollow stem 136 by a plurality of ribs 146 extending inwardly from a support rim 148 extending inwardly from the inner surface of the hollow stem 136. By suspending the ring 144 with the ribs 146 in this manner, openings 150 defined by the ribs 146 may allow a stream of liquid to flow through the cap portion 132 and hollow stem 136 to fill the tank 16. The umbrella valve 106 may be connected to the hollow stem 136 in a similar manner as previously described by inserting the knob 112 upwardly through

the ring 144 such that the ring 144 may engage the knob 112 to retain the umbrella valve 106 in position. While the hollow stem 136 is illustrated and described herein as being attached to the cap portion 132, those skilled in the art will appreciate that the cap portion 132 and hollow stem 136 may alternatively be fabricated as a unitary component from a single piece of material.

**[0064]** The valve body 108 and shaft 110 may be dimensioned so that the valve body 108 may engage and mate with a bottom surface of the support rim 148 to form a substantially air-tight and water-tight seal preventing the accumulated liquid 44 in the tank 16 from leaking out of the quick fill cap 130 through the continuous channel formed by the cap portion 132 and hollow stem 136. In order to ensure that a sufficient seal forms between the valve body 108 and support rim 148, the quick fill cap 130 may further include a support member 152 engaging a bottom surface of the valve body 108 to force the valve body 108 upwardly into engagement with the support rim 148. The support member 152 may be disposed on a support plate 154 suspended from the bottom of the hollow stem 136 by a plurality of spaced support arms 156. The support arms 156 may be spaced apart about the circumference of the hollow stem 136 and support plate 154 to define a plurality of openings 158 through which liquid may flow when a stream of liquid is discharged into the quick fill cap 130.

**[0065]** The quick fill cap 130 may be connected to the fill port 14 so that an outlet (not shown) of a hose, faucet, watering can, or the like, may discharge an output stream of liquid through the quick fill cap 130 and into the tank to form an accumulated amount of liquid in a similar manner as discussed for the previously-described embodiments of quick fill caps. When an outlet is disposed within the channel of the cap portion 132, an output stream of liquid may be discharged from the outlet through the continuous channel formed by the cap portion 132 and the hollow stem 136. The force of the output stream of liquid on the surface of the valve body 108 may be sufficient to cause the outer edges of the resilient valve body 108 to partially or fully disengage from the bottom surface of the support rim 148 as shown in FIG. 21, thereby allowing the output stream of liquid to flow into the tank and increase the accumulated amount of liquid. When the valve body 108 is deflected, the

stream of liquid may flow through the openings 150 defined by the ribs 146, past the deflected valve body 108, and through the openings 158 defined by the support arms 156. The support member 152 may engage the valve body 108 proximate the shaft 110 to prevent causing a substantial amount of deflection or elongation of the shaft 110 under the force of the stream of liquid. When the outlet is removed from the continuous channel of the cap portion 132, or the output stream of liquid is otherwise discontinued, thereby eliminating the force of the output stream of liquid against the surface of the valve body 108, the restorative force of the resilient material from which the umbrella valve 106 is fabricated may cause the valve body 108 to return to its normal shape to again allow the valve body 108 to engage the bottom surface of the support rim 148 to prevent the accumulated liquid from flowing into the quick fill cap 132 through the cavity of the hollow stem 136. Those skilled in the art will also understand that the quick fill cap 130 having the umbrella valve 106 may also be used with toy water guns that do not use a pressurization mechanism.

**[0066]** An alternative embodiment of the quick fill cap 130 is illustrated in FIGs. 22 and 23. In this embodiment, the support member 152 may be replaced by a support member 160 biased against the bottom surface of the valve body 108 by a spring 162. The support member 160 may be a substantially disk shaped, and include a plurality of spaced and outwardly extending fingers 164. The fingers 164 may center the support member 160 under the valve body 108 and define openings therebetween through which discharged liquid may flow when the umbrella valve 106 is open. When an outlet is disposed within the channel of the cap portion 132, an output stream of liquid may be discharged from the outlet through the continuous channel formed by the cap portion 132 and the hollow stem 136. The force of the output stream of liquid on the surface of the valve body 108 may be sufficient to overcome the force of the spring 162 to push the support member 160 downwardly, thereby allowing the outer edges of the resilient valve body 108 to partially or fully disengage from the bottom surface of the support rim 148 as shown in FIG. 23 to allow the output stream of liquid to flow into the tank and increase the accumulated amount of liquid. When the valve body 108 is deflected, the stream of liquid may flow through the openings 150 defined by the ribs 146, past the deflected valve body

108, and through the openings defined by the spaced fingers 164 and the openings 158 defined by the support arms 156. When the outlet is removed from the continuous channel of the cap portion 132, or the output stream of liquid is otherwise discontinued, thereby eliminating the force of the output stream of liquid against the surface of the valve body 108, the restorative force of the valve body 108 and the force of the spring 162 may cause the valve body 108 to return to its normal shape, and the support member 160 to move upwardly to its normal position, to again allow the valve body 108 to engage the bottom surface of the support rim 148 to prevent the accumulated liquid from flowing into the quick fill cap 132 through the cavity of the hollow stem 136.

**[0067]** A still further embodiment of a quick fill cap 170 is illustrated in FIGs. 24 and 25 in which the one-way valve may be a check valve 171. The quick fill cap 170 may be configured without an external funnel, and may include a cap portion 172 that may be engaged by the user to attach and detach the quick fill cap 170 at the fill port 14. The cap portion 172 may include a throughbore 174 having a hollow stem or cylinder 176 disposed therethrough with a common longitudinal axis 177 and forming a continuous channel. The cap portion 132 may also include a gasket 142 as previously described disposed proximate the top of the threaded inner surface 46 of the cap portion 172 to engage the top edge of the fill port 14 when the cap portion 172 is disposed thereon to form a substantially air-tight and water-tight seal between the cap portion 172 and the fill port 14. In the illustrated embodiment, a ring 178 may be suspended within the hollow cylinder 176 by a plurality of ribs 180 extending inwardly from an inner wall of the hollow cylinder 176. By suspending the ring 178 with the ribs 180 in this manner, the ribs 180 may define openings 182 to allow a stream of liquid to flow through the cap portion 172 and hollow cylinder 176 to fill the tank 16.

**[0068]** The check valve 171 of the quick fill cap 170 may have a valve body including an upper flange 184 and a lower flange 186 connected by a shaft 188. The upper flange 184 may be disk-shaped or other shape corresponding to the cross-section of the interior of the hollow cylinder 176, and may be dimensioned such that the upper flange 184 and, consequently, the check valve 171 are slidable within the

hollow cylinder 176 substantially parallel to the longitudinal axis 177. The upper flange 184 may have a hole 190 therethrough proximate the center of the upper flange 184 through which a portion of the shaft 188 may be inserted and secured by adhesive or other fastening mechanism. The upper flange 184 may further include one or more spaced openings 192 therethrough through which a liquid may flow to pass through the quick fill cap 170 and into the tank 16 when the check valve 171 is open.

**[0069]** The lower flange 186 of the check valve 171 may be disk-shaped or other shape corresponding to the cross-section of the bottom edge of the hollow cylinder 176, and may be dimensioned such that that the lower flange 186 extends over the bottom edge of the hollow cylinder 176 and may engage the bottom edge of the hollow cylinder 176 to form a substantially air-tight and water-tight seal therebetween. The lower flange 186 may include a raised outer edge 194 extending upwardly and disposed on the outside of the hollow cylinder 176 when the lower flange 186 engages the bottom edge of the hollow cylinder 176. The lower flange 186 may also have a hole 196 therethrough proximate the center of the lower flange 186 through which a portion of the shaft 188 may be inserted and secured by adhesive or other fastening mechanism when the check valve 171 is assembled onto the cap portion 172. The check valve 171 may further include a gasket 198 disposed on an upper surface of the lower flange 186 to engage the bottom edge of the hollow cylinder 176 when the check valve 171 is closed to form the substantially air-tight and water-tight seal between the bottom edge of the hollow cylinder 176 and the lower flange 186 of the check valve 171.

**[0070]** When the check valve 171 is assembled onto the cap portion 172, an end of the shaft 188 opposite the upper flange 184 may be inserted downwardly through the opening in the ring 178 with a spring 200 disposed between the upper flange 184 and the ring 178, with the shaft 188 and opening in the ring 178 being dimensioned so that the shaft 188 may be slidable within the opening of the ring 178. Once inserted, the end of the shaft 188 extending through the ring 178 may be inserted into the hole 196 through the lower flange 186 and affixed thereto using any appropriate attachment mechanism. The spring 200 may bias the upper flange 184 away from the ring 178 to a normal closed position wherein the lower flange 186 and

gasket 198 may engage the bottom edge of the hollow cylinder 176 to form a substantially air-tight and water-tight seal therebetween. In order to open the check valve 171 to allow liquid flow into the tank through the channel of the quick fill cap 170, the outlet of a faucet, hose, water can or other device may be pressed downwardly against the top surface of the upper flange 184 to cause the check valve 171 to move downwardly against the biasing force of the spring 200 as shown in FIG. 25. As the check valve 171 moves downwardly, the lower flange 186 and gasket 198 may disengage from the bottom surface of the hollow cylinder 176, with the outer edge 194 of the lower flange 186 also moving clear of the bottom edge of the hollow cylinder 176. Once the lower flange 186 and gasket 198 disengage to open the check valve 171, an output stream of liquid may pass through the openings 192 in the upper flange 184, through the hollow cylinder 176, through the openings 182 defined by the ribs 180, and into the tank to add to the accumulated amount of liquid therein. Once the desired amount of liquid is discharged into the tank, the outlet may be disengaged from the upper flange 184 and removed from the hollow cylinder 176. Once the force of the outlet is removed from the upper flange 184, the biasing force of the spring 200 may move the check valve 171 toward the normal closed position with the lower flange 186 and gasket 198 again engaging the bottom edge of the hollow cylinder 176 to form a substantially air-tight and water-tight seal therebetween.

**[0071]** While the preceding text sets forth a detailed description of numerous different embodiments of the invention, it should be understood that the legal scope of the invention is defined by the words of the claims set forth at the end of this patent. The detailed description is to be construed as exemplary only and does not describe every possible embodiment of the invention since describing every possible embodiment would be impractical, if not impossible. Numerous alternative embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims defining the invention.